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**Notes:**

1. Untranslatable words are replaced with asterisks (\*\*\*\*).
2. Texts in the figures are not translated and shown as it is.

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**[Claim(s)]**

[Claim 1]It blows off from two jets in which a hot wind carried out the opening in the right-angled direction to a direction of movement of a printed circuit board in the direction of slant toward a center of a jet of these two parts, And a hot wind after blowing off runs a reflow furnace at which two or more hot wind blow-off heaters of a self-circle method inhaled from a suction port which is carrying out the opening were installed in the center of two jets a printed circuit board, A reflow method carrying out melting of the solder paste applied to a printed circuit board by heating a printed circuit board by a hot wind which blows off from a jet of a hot wind blow-off heater in the direction of slant, and soldering it.

[Claim 2]While two estranged jets are carrying out the opening in the right-angled direction to a direction of movement of a printed circuit board and a hot wind which moreover blew off from two jets blows off in the direction of slant toward a center of two jets, A reflow furnace currently having installed a hot wind blow-off heater of a self-circle method inhaled from a suction port of a center of two jets in a heating zone.

[Claim 3]The reflow furnace according to claim 2 currently having installed said hot wind blow-off heater in a vertical section of a heating zone on both sides of a conveyor.

[Claim 4]The reflow furnace according to claim 2 by which it is installing-in the upper part of heating zone-said hot wind blow-off heater characterized.

[Claim 5]While an electrically heated wire is installed in a box-like main part in which the upper part carried out the opening, A main part is trichotomized by a partition of two sheets by the state where the lower part was open for free passage, and a fan which can attract external gas is installed in a central suction port, And a hot wind blow-off heater installing [ a louver which carries out a strange style ]-in slanting center direction characterized by gas at the jet upper part of both sides.

[Claim 6]The hot wind blow-off heater according to claim 5, wherein said fan is a crossing fan.

[Claim 7]The hot wind blow-off heater according to claim 5, wherein said fan is a sirocco fan.

[Claim 8]said fan -- propeller fan \*\*\*\* -- the hot wind blow-off heater according to claim 5 characterized by things.

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[Detailed Description of the Invention]

[0001]

[Industrial Application] This invention relates to the hot wind blow-off heater installed in the reflow method which carries out heating melting of the solder paste applied to the printed circuit board, and solders a printed circuit board and electronic parts, the reflow furnace used for it, and a reflow furnace.

[0002]

[Description of the Prior Art] If the flux residue has adhered so much, while a long period of time will pass, it will absorb moisture, the printed circuit board generally soldered with a solder paste generates a corrosion product, disconnects copper foil of a printed circuit board, and the lead of electronic parts, and the insulation resistance of a printed circuit board will be lowered, or it will be carried out [ it will be sufficient for it and ].

[0003] Therefore, although solvents which dissolve resin well, such as chlorofluocarbon and a bird crane, were washing the flux residue after soldering conventionally, Since these solvents become the cause of destroying the ozone layer which surround the earth, making the ultraviolet rays from the sun arriving at the earth so much, and making human beings generating skin cancer, the use is regulated.

[0004] Then, recently, by the electronic equipment as which reliability is required like a computer or communication equipment, after soldering, even if it does not perform washing in soldering of a printed circuit board, the solder paste for no washing with little the fall of insulation resistance and generating of a corrosion product has come to be used for it. This solder paste for no washing is little very much, even if the \*\* halogenation thing which causes moisture absorption into flux is not added or it is added, and there are also few amounts of addition of resin with the adhesiveness it is easy to make the garbage leading to moisture absorption and dust adhere.

[0005] Since the solder paste for no washing has little addition of the halogenation thing and resin which have a great effect in reduction of an oxide, If it is used in the atmosphere, i.e., atmosphere with much oxygen, neither the soldering part which oxidized, nor the oxidized powder solder will fully be able to be returned, but the defect of the solder ball etc. which the non-Handaya powder solder to which solder is not attached melts completely, stop spreading, and are made will be generated.

[0006] However, if it is used in the state where the solder paste for no washing does not have oxygen like inactive \*\*\*\* with which nitrogen gas was made filled, either, it will turn out that a defect is not generated and the solder paste for no washing will have been conventionally used at the reflow furnace of an inactive atmosphere.

[0007] The oxygen concentration in an inactive atmosphere reflow furnace has few generating with the lower possible poor one. In order to make oxygen concentration low at an inactive atmosphere reflow furnace, if inactive gas is supplied so much, in a certain grade, oxygen concentration will fall, but then the amount of consumption of expensive inactive gas will increase, and it will be a cost rise. Then, from the electronic

industry, an inactive atmosphere reflow furnace which can lower oxygen concentration by the small inactive gas amount of supply was desired.

[0008]In the reflow furnace, the characteristic that the whole printed circuit board can be heated uniformly is also demanded. It is because heat damage of the electronic parts too high and carried [ temperature could not fully go up / electronic parts /, could not carry out melting of the solder paste, and became non-solder, and ] in a certain portion will be carried out in a certain portion if heating is not uniformly performed to a printed circuit board.

[0009]In a reflow furnace, the difference in temperature of the portion with the highest temperature of a printed circuit board and a portion with the lowest temperature is called  $\Delta T$  (Doelter tee), and the small thing of this  $\Delta T$  can call it the good reflow furnace which can perform uniform heating.

[0010]Generally, since the direction which performs heating of a printed circuit board by a hot wind rather than heating of only radiant heat made  $\Delta T$  small, many inactive atmosphere reflow furnaces of the hot wind type were proposed conventionally. [ the inactive atmosphere reflow furnace (only henceforth a reflow furnace) of the conventional hot wind type ] Are a thing which installs an electrically heated wire above a conveyor with a fan, and makes a hot wind only agitate in a furnace, or (JP,61-38985,B), Make it circulate, without being between the upper and lower sides and making a hot wind collide with the vertical section of a conveyor, or (JP,64-83395,A), Or as this invention applicant proposed, it is between the upper and lower sides of a conveyor, and an admission port and an outlet are shifted and installed and it is made to have a heating gas facing-up passage area, a heating gas collision field, and a heating gas facing-down passage area (JP,H4-81269,A).

[0011]

[Problem to be solved by the invention]However, in a little inactive gas, the conventional reflow furnace cannot lower oxygen concentration enough, and cannot make  $\Delta T$  not much small, either. There is this invention in providing the hot wind blow-off heater used for the reflow method, the reflow furnace, and it which can lower oxygen concentration and can moreover make  $\Delta T$  very small also with a little inactive gas.

[0012]

[Means for solving problem]The result of having repeated examination wholeheartedly about the cause by which this invention person was not able to make oxygen concentration low at the conventional reflow furnace, Since the conventional reflow furnace is what only agitate a hot wind, or two or more heaters are between the upper and lower sides, and a hot wind is circulated, or is the structure of making it colliding partially, When the printed circuit board advanced into the hot wind blow-off portion, it turned out that a hot wind flows to the heater which the flow direction of the hot wind was changed and adjoined by the printed circuit board, it influences to the entrance of a furnace further, external air invades from the entrance of a furnace, and oxygen concentration is raised.

[0013]Uniform heating was not fully performed by the conventional reflow furnace because hot wind spraying stable to the non-heating thing was not completed. That is, in the conventional reflow furnace,

when the hot wind from the hot wind blow-off heater installed up and down balances and suited mutually, respectively, were performing uniform heating, but. If a printed circuit board advances between up-and-down hot wind blow-off heaters, the mutual balance during the upper and lower sides will collapse, and it will become uneven heating.

[0014]Then, even if he did not maintain mutual balance among two or more hot wind blow-off heaters, it not only can heat a printed circuit board uniformly, but this invention person completed this invention paying attention to the ability to also prevent invasion of the open air, when blow off of the independently stable hot wind could be performed.

[0015]This invention blows off from two jets in which a hot wind carried out the opening in the right-angled direction to a direction of movement of a printed circuit board in the direction of slant toward a center of a jet of these two parts, And a hot wind after blowing off runs a reflow furnace at which two or more hot wind blow-off heaters of a self-circle method inhaled from a suction port which is carrying out the opening were installed in the center of two jets a printed circuit board, By heating a printed circuit board by a hot wind which blows off from a jet of a hot wind blow-off heater in the direction of slant, it is a reflow method carrying out melting of the solder paste applied to a printed circuit board, and soldering it.

[0016]Two estranged jets are carrying out the opening of this invention in the right-angled direction to a direction of movement of a printed circuit board, And while a hot wind which blew off from two jets blows off in the direction of slant toward a center of two jets, It is the reflow furnace currently having installed a hot wind blow-off heater of a self-circle method inhaled from a suction port of a center of two jets in a heating zone.

[0017]While an electrically heated wire is installed in a box-like main part in which the upper part carried out the opening, [ this invention ] A main part is trichotomized by a partition of two sheets by the state where the lower part was open for free passage, and a fan which can attract external gas is installed in a central suction port, And it is also a hot wind blow-off heater installing [ a louver which carries out a strange style ]-in slanting center direction characterized by gas at the jet upper part of both sides.

[0018]In a reflow furnace of this invention, a hot wind blow-off heater may be installed only in a vertical section of a preliminary heating zone and this heating zone, or the upper part, or a hot wind blow-off heater can also be installed in either a preliminary heating zone or this heating zone.

[0019]A fan installed in a hot wind blow-off heater of this invention can be used with any fans, if a crossing fan, a sirocco fan, a propeller fan, etc. can attract gas and can ventilate.

[0020]

[Function]Having inhaled the hot wind which provides two jets in one hot wind blow-off heater, and blows off, respectively from the suction port between two jets A sake, When circulation of a hot wind is performed within one hot wind blow-off heater and a hot wind blow-off heater is installed up and down, even if a printed circuit board advances between them, it is between the upper and lower sides, and a hot wind is not confused, and it does not interfere with the hot wind of the adjoining hot wind blow-off heater.

[0021]

[Working example]Based on Drawings, this invention is explained below. Drawing 1 is a front sectional view of the reflow furnace of this invention, and drawing 2 is an eye squinting sectional view of the hot wind blow-off heater of this invention.

[0022]A hot wind blow-off heater of this invention is explained first. Although what is installed in the upper part, and a thing to install in the lower part are the same structures, a hot wind blow-off heater blows off up, and explains what is installed in the lower part as shown in drawing 2, i.e., a hot wind.

[0023]The partitions 2 and 2 of two sheets are installed with a box form with which the upper part carried out the opening of the hot wind blow-off heater 1.

It is trichotomized after the lower part has been open for free passage by this partition.

A trichotomized center serves as the suction port 3, and the both sides serve as the jets 4 and 4. A hot wind blow-off heater of this invention is installed in a reflow furnace so that a jet which carried out the opening oblong may become right-angled to a direction of movement of a printed circuit board.

[0024]The fan 6 which rotates by the motor 5 attached to the exterior of a main part is installed in the suction port 3. A fan shown in an embodiment is the crossing fan by whom many long fins were installed cylindrical. This fan inhales gas inside from the upper part of the suction port 3.

[0025]The electrically heated wire 7 is constructed over the inside by the jets 4 and 4 in the both sides of the suction port 3.

Much louver 8 -- is installed in the upper part of a jet.

The inclination that a hot wind blows off to the upper part of the center 3, i.e., a suction port, is given to the louver 8.

[0026]The wind direction guide 9 which made the cylinder 1/4 circle is installed in the bottom corner of the suction ports 4 and 4, and this two guide is installed back to back in the center of the bottom of a suction port.

[0027]In the hot wind blow-off heater of this invention, if the fan 6 rotates, external gas will be inhaled from the central suction port 3, and the wind direction guides 9 and 9 of the center of the undersurface will distribute it to the jets 4 and 4 of both sides. Although the gas which flowed into the jet 4 is heated with the electrically heated wire 7 constructed over the jet, serves as a hot wind and it blows off from the jet upper part, Since louver 8 -- of a large number inclined in the center direction is installed in the jet upper part, a hot wind blows off above the suction port 3 by this louver.

[0028]In the upper part of the suction port 3, since it is rotating so that the fan 6 installed into the suction port 3 may draw gas in an inside, the hot wind which blew off from the jets 4 and 4 is inhaled by the suction port 3. That is, the hot wind blow-off heater of this invention is performing self-circulation of inhaling oneself the hot wind which blew off itself alone.

[0029]Next, the reflow furnace of this invention is explained.

[0030]In the reflow furnace 10, the inside of a furnace serves as the preliminary heating zone P, this heating zone R, and the cooling zone C.

In the furnace, a pair of chain conveyors 11 are running toward the direction of cooling zone C from the

preliminary heating zone P (arrow A).

The air invasion prevention zones 12 and 12 are formed in the entrance of a preliminary heating zone, and the exit of a cooling zone.

[0031] Hot wind blow-off heater 1 -- is installed in the vertical section of a chain conveyor at the place of the preliminary heating zone P and this heating zone R.

[0032] The hot wind blow-off heater 1 blows off a hot wind from two jets which carried out the opening in the right-angled direction to the direction of movement A of a printed circuit board. This hot wind blow-off heater has the two estranged jets 4 and 4, and a hot wind is a self-circle method by which this hot wind is inhaled from the central suction port 3, while a hot wind blows off from two jets aslant toward those centers. In the embodiment shown in drawing 1, this hot wind blow-off heater 1 is installed in the vertical section of the preliminary heating zone P in a furnace, and this heating zone R.

[0033] Between the hot wind blow-off heaters 1 contiguous to the hot wind blow-off heater 1, the two conveyor receptacles 13 and 13 of section T type are attached at a time to the direction of movement of a printed circuit board at the method of width.

Conveyor receptacle 14 -- of section L type is attached to the air invasion prevention zones 12 and 12 of an entrance.

Although these conveyor receptacles make it run a chain conveyor in response to the lower part of the chain conveyor 11, [ receptacles ] The conveyor receptacle 13 of section T type can prevent movement of the hot wind between the adjoining hot wind blow-off heaters, and the conveyor receptacle 14 of the section L type of an air invasion prevention zone can prevent now invasion of the open air from an entrance.

[0034] Although it is the same structure as the above-mentioned hot wind blow-off heater 1, the blow-off cooler 15 of the cold style with which the electrically heated wire is not attached is installed in the lower part of the cooling zone C. The gas which blew off from the jet of both sides toward the center like the hot wind blow-off heater is inhaled by the central suction port, it flows into a jet through the lower part of a partition, and this blow-off cooler of the cold style is also performing self-circulation of blowing off again. Therefore, self-circulation of the hot wind blow-off heater 1 of this heating zone R where the blow-off cooler of the cold style also adjoined cannot be barred, and invasion of the open air from an exit can also be prevented.

[0035] The turbulent flow prevention device 16 used as section mountain shape is installed in the upper part of the cooling zone C. If this does not have a blow-off cooler of the cold style in the upper part when a printed circuit board advances and it starts on one jet of a blow-off cooler of the cold style, and a suction port, \*\*\*\* which blew and came out of another jet will flow up. The strange style of the \*\*\*\* which besides flowed to a way is carried out, and it is made not to make it flow into others in a portion of mountain shape.

[0036] Then, a reflow method in a reflow furnace in which the above-mentioned hot wind blow-off heater was installed is explained.

[0037] Printed circuit board W enters from an entrance, and is conveyed in the direction of arrow A by conveyor 11. If printed circuit board W arrives at the preliminary heating zone P, it will be heated by a hot wind which blew off from the hot wind blow-off heaters 1 and 1 installed in a vertical section on both sides of

a conveyor. At this time, a hot wind blows off from the two jets 4 and 4 which carried out the opening in the right-angled direction to a direction of movement of a printed circuit board aslant toward a center. As for a printed circuit board, back-and-front both sides are heated by this hot wind that blows off aslant. And a hot wind after heating a printed circuit board is inhaled from the central suction port 3.

[0038]Thus, a hot wind which blew off from a hot wind blow-off heater carries out self-circulation, without other hot wind blow-off heaters interfering, in order to return to the same hot wind blow-off heater. Therefore, spraying of an always stable hot wind is performed and uniform heating of the printed circuit board is carried out.

[0039]The printed circuit board by which preliminary heating was carried out in the preliminary heating zone P trespasses upon this heating zone R, it is heated like preliminary heating more than the melting temperature of a solder paste with the up-and-down hot wind blow-off heaters 1 and 1, and soldering is performed. Heating stabilized without the hot wind blow-off heater and the blow-off cooler of the cold style with which it adjoined also at this time interfering is performed.

[0040]The printed circuit board which soldering in this heating zone ended is sent to the cooling zone C, and is cooled with the blow-off cooler of the cold style here below at the melting temperature of solder. The atmosphere which the blow-off cooler of the cold style did not influence the circumference here, and was stabilized is maintained.

[0041]As shown in drawing 1, the hot wind blow-off heater of this invention was installed in the preliminary heating zone and this heating zone of a reflow furnace one pair with two pairs at the vertical section, respectively. Nitrogen gas of 100 l./m is supplied in this reflow furnace, and it was made for the degree of substrate surface temperature to be 230 °C in 150 °C and this heating zone in a preliminary heating zone in the degree of substrate surface temperature. It was made to run the printed circuit board (150 mm x 150 mm) by which various kinds of electronic parts were mounted in the reflow furnace made into such conditions, and the temperature of each portion was measured. As a result, the temperature of QFP and the difference in temperature of the printed circuit board with the smallest calorific capacity itself with the biggest calorific capacity, i.e.,  $\Delta T$ , were a value as low as 5 °C.

[0042]The printing application of the solder paste for no washing is carried out, and various kinds of electronic parts are carried in a printed circuit board on it. When carrying out the continuation run of this printed circuit board into the reflow furnace of this invention, the oxygen concentration in a furnace was as low as 100 ppm, and, moreover, there was little change. When the printed circuit board which came out from the reflow furnace was observed, there was no poor soldering and there was also no heat damage to an electronic article.

[0043]

[Effect of the Invention]As explained above, according to this invention, the quantity of the inactive gas supplied in a furnace at least, Since it not only excels in the economical efficiency in which oxygen concentration can be lowered, but the value of  $\Delta T$  can be made very small to the extent that a defect is not generated with soldering using the solder paste for no washing, Uniform heating of a printed circuit

board can be performed and soldering with the reliability of not doing heat damage to the non-Handaya electronic parts can also be performed.

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[Brief Description of the Drawings]

[Drawing 1]The front sectional view of the reflow furnace of this invention

[Drawing 2]The eye squinting sectional view of the hot wind blow-off heater of this invention

[Explanations of letters or numerals]

1 Hot wind blow-off heater

2 Partition

3 Suction port

4 Jet

6 Fan

7 Electrically heated wire

8 Louver

9 Wind direction guide

10 Reflow furnace

11 Chain conveyor

12 Air invasion prevention zone

P Preliminary heating zone

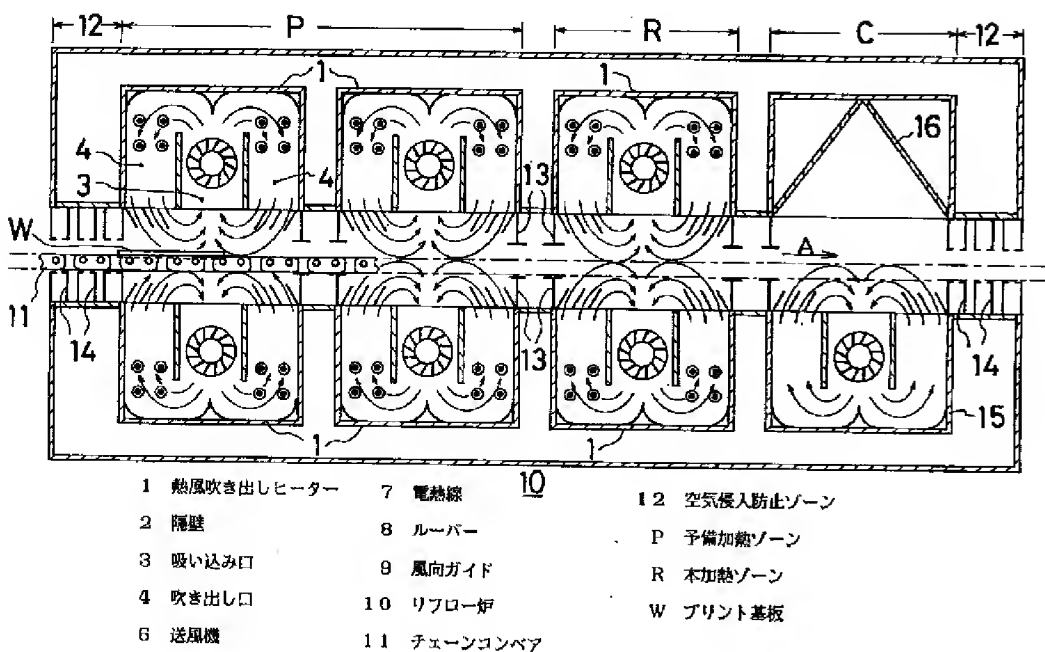
R This heating zone

W Printed circuit board

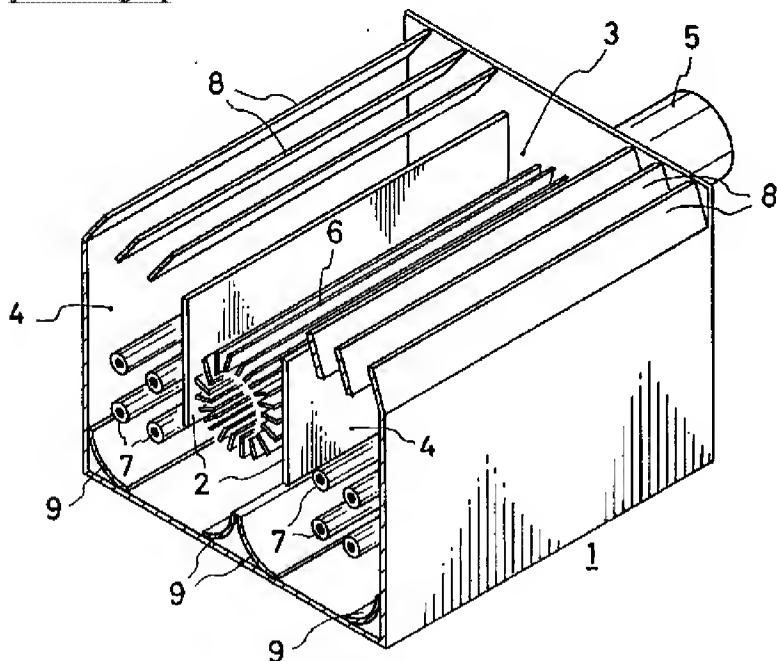
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[Drawing 1]





[Drawing 2]



[Translation done.]